

MANUFACTURING APPLICATIONS

COURSE DESCRIPTION

Manufacturing Applications is an 11th - 12th-grade course for students interested in entering the workforce or pursuing higher education in the manufacturing area. The course requires students to solve problems in a real-world manufacturing context. Problems address critical areas identified by industry and supported by relevant national standards. The course is structured as a series of simulation units. The simulations require students to identify problems in a manufacturing company based on data supplied in typical management reports. Students work in teams of four to six. Teams test and refine proposed solutions with computer simulations. All teams work on the same problem concurrently. At the end of each unit, students present team findings and recommendations to the class and to a panel of manufacturing industry representatives, which acts as the board of directors.

It is strongly recommended that administration and guidance follow the scope and sequence and course recommendations as listed.

Recommended: Principles of Machining, Principles of Machining and Manufacturing, or Principles of Engineering, Algebra I, Algebra II, Geometry

Recommended Credits: 2

Recommended Grade Level(s): 11th - 12th

Number of Competencies: 54

MANUFACTURING APPLICATIONS

STANDARDS

- 1.0** Students will perform safety examinations and maintain safety records.
- 2.0** Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.
- 3.0** Students will integrate reading, writing, math, and science skills and understand the impact of academic achievement in the work place.
- 4.0** Students will research employment opportunities within the manufacturing industry using appropriate job-search strategies and interviewing behaviors.
- 5.0** Students will determine factors that influence strategic technology and human resource decisions in manufacturing.
- 6.0** Students will correlate human factors with economic and organizational outcomes in a manufacturing environment.
- 7.0** Students will demonstrate safe practices, environmental hazard prevention and treatment in a manufacturing organization.
- 8.0** Students will design simple parts as two- and three-dimensional scale drawings and orthographic projections using a CAD program.
- 9.0** Students will create a product using CAD software and the application of the knowledge of the manufacturing processes.
- 10.0** Students will research, explain, and illustrate the elements of automation in manufacturing.

MANUFACTURING APPLICATIONS

STANDARD 1.0

Students will perform safety examinations and maintain safety records.

LEARNING EXPECTATIONS

The student will:

- 1.1** Demonstrate a positive attitude regarding safety practices and issues.
- 1.2** Use and inspect personal protective equipment.
- 1.3** Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.4** Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.5** Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.6** Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards.
- 1.7** Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures.
- 1.8** Demonstrate appropriate related safety procedures.
- 1.9** Pass with 100 % accuracy a written examination relating to safety issues
- 1.10** Pass with 100% accuracy a performance examination relating to safety.
- 1.11** Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 1.1A** Is attentive during safety discussions.
- 1.1B** Actively seeks information about safe procedures.
- 1.1C** Responds positively to instruction, advice, and correction regarding safety issues.
- 1.1D** Does not deliberately create or increase hazards, such as by horseplay, practical jokes, or creating distractions.
- 1.1E** Reports to school or work physically ready to perform to professional standards, such as rested, or not impaired by medications, drugs, alcohol, etc.
- 1.2** Selects, inspects, and uses the correct personal protective equipment for the assigned task.
- 1.3A** Inspects power tools for intact guards, shields, insulation, and other protective devices.
- 1.3B** Inspects extension cords for the presence of a functional ground connection, prior to use.
- 1.3C** Operates and maintains tools in accordance with manufacturer's instructions and as required by regulation or company policy.
- 1.3D** Properly places and secures ladders and scaffolding prior to use.

- 1.4A** Is observant of personnel and activities in the vicinity of the work area.
- 1.4B** Warns nearby personnel, prior to starting potentially hazardous actions.
- 1.5A** When asked to use a new hazardous material, retrieves MSDSs (material safety data sheets), and identifies the health hazards associated with the new material.
- 1.5B** Reports hazards found on the job site to the supervisor.
- 1.6A** Erects shields, barriers, and signage to protect coworkers and bystanders prior to starting potentially hazardous tasks.
- 1.6B** Provides and activates adequate ventilation equipment as required by the task.
- 1.7A** Reports all injuries to self to the immediate supervisor.
- 1.7B** Reports observed unguarded hazards to their immediate supervisor.
- 1.8** Complies with personal assignments regarding emergency assignments.
- 1.9** Passes with 100% accuracy a written examination relating specifically to content area.
- 1.10** Passes with 100% accuracy a performance examination relating specifically to welding tools, equipment and supplies.
- 1.11** Maintains a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

SAMPLE PERFORMANCE TASKS

These are sample projects of the type and scale recommended to address one or more of the learning expectations for this standard. Other projects can be used at the instructor's discretion.

- Conduct a practice drill simulating a hazardous solvent spill in which an emergency action plan is to be implemented.
- Instruct a visitor to obviously approach the vicinity of a student conducting a hazardous activity and note the level of awareness demonstrated by the student.
- For a project requiring the use of ladders and/or scaffolding, note the proper placement and securing procedures followed by students.

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995. International Technology Education Association. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001. Ford Academy of Manufacturing Sciences (FAMS curriculum). Project Lead the Way curriculum. SkillsUSA, *Professional Development Program*, SkillsUSA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies, *Total Quality Management*, SkillsUSA, English/Communications/Writing/Reading/Problem-Solving/Teamwork skills and content.

MANUFACTURING APPLICATIONS

STANDARD 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 2.1** Cultivate positive leadership skills.
- 2.2** Participate in the student organization directly related to their program of study as an integral part of classroom instruction.
- 2.3** Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.4** Participate as a team member in a learning environment.
- 2.5** Respect the opinions, customs, and individual differences of others.
- 2.6** Build personal career development by identifying career interests, strengths, and opportunities.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

Given a simulated manufacturing scenario, the student:

- 2.1A** Demonstrates character and leadership using creative-and critical-thinking skills.
- 2.1B** Uses creative thought process by “thinking outside the box.”
- 2.2A** Relates the creed, purposes, motto, and emblem of their student organization, directly related to personal and professional development.
- 2.2B** Plans and conducts meetings and other business according to accepted rules of parliamentary procedure.
- 2.3A** Makes decisions and assumes responsibilities.
- 2.3B** Analyzes a situation and uses the Professional Development Program or career technical student organization materials directly related to the student’s program of study to resolve it.
- 2.3C** Understands the importance of learning new information for both current and future problem solving and decision making.
- 2.4A** Organizes committees and participates in functions.
- 2.4B** Cooperates with peers to select and organize a community service project.
- 2.5A** Researches different customs and individual differences of others.
- 2.5B** Interacts respectfully with individuals of different cultures, gender, and backgrounds.
- 2.5C** Resolves conflicts and differences to maintain a smooth workflow and classroom environment.
- 2.6A** Creates personal career development by identifying career interests, strengths, and opportunities.
- 2.6B** Identifies opportunities for career development and certification requirements.

- 2.6C** Plans personal educational paths based on available courses and current career goals.
- 2.6D** Creates a resumé that reflects student's skills, abilities, and interests.

SAMPLE PERFORMANCE TASKS

- Create a leadership inventory and use it to conduct a personal assessment.
- Participate in various career technical student organizations' programs and/or competitive events.
- Implement an annual program of work.
- Prepare a meeting agenda for a specific career technical student organization monthly meeting.
- Attend a professional organization meeting.
- Develop a program of study within their career opportunities.
- Participate in the American Spirit Award competition with SkillsUSA.
- Complete *Professional Development Program Level I and Level II*, SkillsUSA.

INTEGRATION/LINKAGES

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International Technology Education Association. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001.

Ford Academy of Manufacturing Sciences (FAMS curriculum).

Project Lead the Way curriculum. SkillsUSA, *Professional Development Program*, SkillsUSA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies, *Total Quality Management*, SkillsUSA, English/Communications/Writing/Reading/Problem-Solving/Teamwork skills and content.

MANUFACTURING APPLICATIONS

STANDARD 3.0

Students will integrate reading, writing, math, and science skills and understand the impact of academic achievement in the work place.

LEARNING EXPECTATIONS

The student will:

- 3.1** Assume responsibility for accomplishing classroom assignments and workplace goals within accepted time frames.
- 3.2** Develop advanced study skills.
- 3.3** Demonstrate and use written and verbal communication skills.
- 3.4** Read and understand technical documents such as regulations, manuals, reports, forms, graphs, charts, and tables related to manufacturing.
- 3.5** Apply the foundations of mathematical principles such as algebra, geometry, and advanced math to solve problems related to manufacturing.
- 3.6** Apply basic scientific principles and methods to solve problems and complete tasks related to manufacturing.
- 3.7** Understand computer operations and related applications to input, store, retrieve, and output information as it relates to the course.
- 3.8** Research, recognize, and understand the interactions of the environment and *green* issues as they relate to the course work and to a global economy.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

Given a simulated manufacturing scenario, the student:

- 3.1A** Uses appropriate time management to achieve goals.
- 3.1B** Arrives at school on time each day.
- 3.1C** Completes assignments and meets deadlines.
- 3.2A** Assesses current personal study skills.
- 3.2B** Demonstrates advanced note-taking ability.
- 3.2C** Formulates appropriate study strategies for given tasks.
- 3.3A** Communicates ideas, information, and messages in a logical manner.
- 3.3B** Fills out forms, time sheets, reports, logs, and documents to comply with class and project requirements.
- 3.4A** Reads and understands technical documents and uses industry jargon, acronyms, and terminology related to manufacturing appropriately.
- 3.4B** Recognizes the meaning of specialized words or phrases unique to the career and manufacturing industry.
- 3.5A** Utilizes computation in adding, subtracting, multiplying, and dividing of whole numbers, fractions, decimals, and percents.
- 3.5B** Chooses the right mathematical method or formula to solve a problem.
- 3.5C** Performs math operations accurately to complete classroom and lab tasks.

- 3.6A** Understands scientific principles critical to the course.
- 3.6B** Applies scientific principles and technology to solve problems and complete tasks.
- 3.6C** Has knowledge of the scientific method (e.g., identifies the problem, collects information, forms opinions, and draws conclusions).
- 3.7A** Uses basic computer hardware (e.g., PCs, printers) and software to perform tasks as required for the course work.
- 3.7B** Understands capabilities of computers and common computer terminology (e.g., program, operating system).
- 3.7C** Applies the appropriate technical solution to complete tasks.
- 3.7D** Inputs data and information accurately for the course requirements.
- 3.8A** Researches and recognizes *green* trends in career area and industry.
- 3.8B** Examines current environmentally friendly trends.
- 3.8C** Applies sustainability practices by understanding processes that are non-polluting, conserving of energy and natural resources, and economically efficient.

SAMPLE PERFORMANCE TASKS

- Examine and compile different learning styles for portfolios.
- Create calendars containing all activities and obligations for one month. Discusses how to handle conflicting or competing obligations then complete daily and weekly plans showing tasks, priorities, and scheduling.
- Complete self-assessments of study habits.
- Compute precise and exact measurements.
- Explore study strategies for different subjects and tasks then analyze two homework assignments and select the best strategies for completing them.
- Create “life maps” showing necessary steps or “landmarks” along the path to personal, financial, educational, and career goals.
- Take notes during counselor classroom visits and work in small groups to create flow charts of the path options.
- List attitudes that lead to success then rate individually in these areas. Work together to suggest strategies for overcoming the weaknesses identified own and partners’ self-assessments then share with the class the strategies developed.
- Research the Internet and other technology to collect and analyze data concerning climate change.
- Keep a data file of alternative energy sources and the sources’ impact on the environment.
- Develop a recycling project at home or for the school environment.

INTEGRATION/LINKAGES

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MANUFACTURING APPLICATIONS

STANDARD 4.0

Students will research employment opportunities within the manufacturing industry using appropriate job-search strategies and interviewing behaviors.

LEARNING EXPECTATIONS

The student will:

- 4.1** Demonstrate the use of job-search strategies.
- 4.2** Demonstrate appropriate interview and workplace dress and behavior.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 4.1A** Generates an effective resumes.
- 4.1B** Uses the Internet and other resources (i.e., LinkedIn, Zoominfo, VisualCU, Career Builder, Monster Job), to execute job searches.
- 4.1C** Completes standard employment application forms.
- 4.2A** Distinguishes between positive and negative interview behaviors.
- 4.2B** Models appropriate dress for an employment interview.
- 4.2C** Prepares appropriate responses to common interview questions.

SAMPLE PERFORMANCE TASKS

- Students will formulate a list of abilities and skills from a self-assessment.
- Students will complete a self-assessment to clarify values and create a baseline for team attitude building.
- Students will evaluate raw data from self-assessment and determine personal values that are needed to work in teams.
- Students will create a personal commercial template.
- Students will create and utilize a cover letter template and reference letter.
- Students will critique “best interview tips” in a group mock interviewing assignment.
- Students will create a video of interviewing for employment opportunities.
- Students prepare resumes based on their assigned roles in the simulations. At the end of the school year, students and/or an advisory board will evaluate candidates for hypothetical job openings based on the resumes and mock interviews.

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MANUFACTURING APPLICATIONS

STANDARD 5.0

Students will determine factors that influence strategic technology and human resource decisions in manufacturing.

LEARNING EXPECTATIONS

The student will:

- 5.1** Investigate potential implications of technological innovations for manufacturing organizations.
- 5.2** Explore the short- and long-term costs of and returns on human resource development.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 5.1A** Makes strategic choices involving technological resources.
- 5.1B** Predicts the potential effects of strategic choices involving technological resources.
- 5.2A** Makes strategic choices involving human resources.
- 5.2B** Judges the economic value of employee development versus employee replacement.

SAMPLE PERFORMANCE TASKS

- Students participate in a manufacturing simulation that allows them to experience the trade-offs involved in making a decision to change manufacturing processes versus changing the workforce.
- Students participate in a manufacturing simulation that requires them to choose between upgrading the workforce through continuing education or replacing current workers and training new ones.
- Students participate in a manufacturing simulation that requires them to contrast the benefits and costs of quality management practices.

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MANUFACTURING APPLICATIONS

STANDARD 6.0

Students will correlate human factors with economic and organizational outcomes in a manufacturing environment.

LEARNING EXPECTATIONS

The student will:

- 6.1** Analyze the effects of employee absenteeism on product cost and worker morale.
- 6.2** Assume responsibility and demonstrate strong work ethic by exerting effort and perseverance in doing work tasks according to high standards.
- 6.3** Analyze the relationship between productivity, profitability, and wages.
- 6.4** Investigate and resolve ethical decisions about manufacturing and the workplace.
- 6.5** Exemplify high standards of attendance, punctuality, and involvement in all major work tasks.
- 6.6** Maximize the efficiency of the manufacturing system with respect to time and cost.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 6.1A** Calculates the effects of absenteeism on product cost.
- 6.1B** Explains the implications of absenteeism for worker morale.
- 6.3A** Determines and explains the factors that influence the setting of employee wages.
- 6.3B** Correlates wage determination with productivity and profitability.
- 6.3C** Justifies the short-term costs of quality management based on long-term profitability.
- 6.4A** Applies personal ethics to workplace decision-making.
- 6.4B** Formulates the workplace decisions based on values.
- 6.4C** Illustrates in a group activity the attitudes or conditions that directly or indirectly influence the climate of the work place.
- 6.6A** Assesses the short-term costs of quality management based on long-term profitability.
- 6.6C** Correlates quality with the critical success factors of an organization.
- 6.6D** Devises modifications to a manufacturing process based on desired business outcomes.

SAMPLE PERFORMANCE TASKS

- Research the Internet to locate biographical information on individuals in the manufacturing industry and chart personality characteristics.
- Present a report to the total group on “How to Develop a Positive Workplace Climate.”
- Develop a plan for continuing education in the manufacturing industry.
- Create a chart showing personal mind-sets that will affect personal growth positively and negatively.
- Participate in various SkillsUSA programs and/or competitive events.

- Interview individuals in the manufacturing industry that work in teams.
- Participate in the American Spirit Award competition with SkillsUSA.
- Participate in job shadowing or internship within the manufacturing industry.
- Students participate in a manufacturing simulation that requires them to identify effects of employee absenteeism on product cost and worker morale.
- Students participate in a manufacturing simulation that requires them to infer relationships between wages and business profit and productivity.
- Students participate in a manufacturing simulation that offers ethical dilemmas resulting from competing values in the workplace, such as co-worker loyalty versus reporting safety violations.

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MANUFACTURING APPLICATIONS

STANDARD 7.0

Students will demonstrate safe practices, environmental hazard prevention and treatment in a manufacturing organization.

LEARNING EXPECTATIONS

The student will:

- 7.1** Explore and compare the chemical and physical properties of materials used in a manufacturing process.
- 7.2** Explore the role of manufacturing safety practices in an economic context.
- 7.3** Use Material Safety Data Sheets (MSDS) to assess and demonstrate the safety guidelines and regulations for the disposal of waste materials.
- 7.4** Analyze environmental hazards and preventions procedures for machines and equipment used in a manufacturing organization.
- 7.5** Perform environmental hazards safety evaluations for machine and equipment operations.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 7.1A** Identifies and classifies materials commonly used in manufacturing by their chemical and physical properties.
- 7.1B** Calculates how the chemical and physical properties of a given material will impact the way it is processed.
- 7.3A** Executes assigned responsibilities and document the appropriate handling and disposal of environmentally hazardous materials according to OSHA requirements.
- 7.3B** Communicates in writing and verbally the actions taken to handle and use coolant, cutting fluids, and lubricants.
- 7.3C** Appropriately handles and stores hazardous materials according to safety practices required by OSHA and EPA.
- 7.5** Maintains a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

SAMPLE PERFORMANCE TASKS

- Students will participate in a lab setting provided with several different scenarios with various materials. Students will calculate density and stress tests on the materials.
- Students participate in a manufacturing simulation that requires them to implement appropriate safety procedures handling hazardous and environmentally dangerous materials.

INTEGRATION LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995. International Technology Education Association. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001. Ford Academy of Manufacturing Sciences (FAMS curriculum). Project Lead the Way curriculum. SkillsUSA, *Professional Development Program*, SkillsUSA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies, *Total Quality Management*, SkillsUSA, English/Communications/Writing/Reading/Problem-Solving/Teamwork skills and content.

MANUFACTURING APPLICATIONS

STANDARD 8.0

Students will design simple parts as a two- and three-dimensional scale drawings and orthographic projections using a CAD program.

LEARNING EXPECTATIONS

The student will:

- 8.1** Design a simple part as a two-dimensional scale plan drawing.
- 8.2** Design a simple part and illustrate the orthographic projections of a three-dimensional object.
- 8.3** Design a simple part and illustrate the drawings of three-dimensional objects, including parallel extrusion, perspective extrusion, and three-dimensional isometrics.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 8.1A** Represents a location and size of all entities in the drawing.
- 8.1B** Uses dimension information in the drawing.
- 8.1C** Uses symbol libraries in the drawing where available and appropriate.
- 8.2A** Demonstrates layer structure to maximize the drawing's utility.
- 8.2B** Represents orthographic views of a simple part, solid objects, and/or a product item.
- 8.2C** Uses dimension information in the drawing to enhance the simple part, solid objects, and/or a product item.
- 8.3A** Uses the appropriate extrusion technique for the intended purpose of the three-dimensional object drawing.
- 8.3B** Portrays isometric entities with appropriate skew angles.
- 8.4A** Combines plane and three-dimensional representations along with appropriate cross-sectional drawings to represent interior detail.
- 8.4B** Indicates the location of cross sections.

SAMPLE PERFORMANCE TASKS

- Complete a plan drawing of an assigned simple part or product item using a CAD software program.
- Complete a plan drawing of the classroom or computer lab using a CAD software program..
- Complete a solid-object drawing of the exterior details of an assigned simple part or product item using a 3D software program.
- Create a three-dimensional drawing of a student or teacher desk.
- Create a three-dimensional drawing using extrusion of a spur gear.
- Complete a three-dimensional drawing using a solid modeling software program of three components interacting with each other.
- Complete a project to draw an assembly and exploded view, e.g., a belt tightener, using a solid modeling software program.

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MANUFACTURING APPLICATIONS

STANDARD 9.0

Students will create a product using CAD software and the application of the knowledge of the manufacturing processes.

LEARNING EXPECTATIONS

The student will:

- 9.1** Research and apply the manufacturing processes for a given product.
- 9.2** Differentiate between primary and secondary manufacturing processes.
- 9.3** Research and apply prototyping processes to a given product.
- 9.4** Implement a transformation process for the creation of a product from CAD software to a CNC program.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 9.1A** Explores innovative production techniques and materials that are having an impact on the design industry worldwide.
- 9.1B** Analyzes the typical applications, design opportunities, and considerations each process offers and diagnoses information on cost, speed, and environmental impact
- 9.2A** Defines and illustrates a primary manufacturing process.
- 9.2B** Defines and illustrates a secondary manufacturing process.
- 9.2C** Designs and constructs a semifinal product using raw materials, then, implementing it into a secondary process.
- 9.3A** Defines and explores prototyping processes.
- 9.3B** Researches, compares, and contrasts domestic manufacturing prototypes versus foreign manufacturing prototypes.
- 9.3C** Designs and creates a prototype of a household product that can be manufactured in either the domestic and/or foreign market.

SAMPLE PERFORMANCE TASKS

- Explore several innovative production techniques and materials that are having an impact on the design industry worldwide and present a PowerPoint presentation illustrating the effect in manufacturing.
- Research a case study on a product or component being manufactured at a leading international supplier and illustrate the impact on the global economy.
- Design and construct a semifinal product using raw materials then implementing it into a secondary process.
- Design and create a prototype of a household product that can be manufactured in either the domestic and/or foreign market. The entire process should include research documentation of the purpose of the product, targeted audience, orthographic drawings, CAD drawings, and solid modeling of the product.

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Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995.

International Technology Education Association. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001.

Ford Academy of Manufacturing Sciences (FAMS curriculum).

Project Lead the Way curriculum. SkillsUSA, *Professional Development Program*, SkillsUSA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies, *Total Quality Management*, SkillsUSA, English/Communications/Writing/Reading/Problem-Solving/Teamwork skills and content.

MANUFACTURING APPLICATIONS

STANDARD 10.0

Students will research, explain, and illustrate the elements of automation in manufacturing.

LEARNING EXPECTATIONS

The student will:

- 10.1** Research the history of automation and the impact it has in manufacturing.
- 10.2** Explain the advantages and disadvantages of automation in manufacturing.
- 10.3** Investigate automation-related careers in manufacturing.
- 10.4** Explore and illustrate the controversial factors of automation.
- 10.5** Define and research the history of robots and the technological development.
- 10.6** Classify and describe the different types of robots.
- 10.7** Design and create a robotic device using a manufacturing process and/or a simulation software package.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 10.1A** Creates and illustrates a timeline on the history of automation in manufacturing.
- 10.1B** Describes and illustrates the impact automation has had on manufacturing.
- 10.2** Discriminates the advantages and disadvantages of automation in manufacturing.
- 10.3** Identifies several major occupations that have been created because of automation.
- 10.4** Identifies and explains several controversial issues that are a result of automation in manufacturing.
- 10.5** Describes and explains the implementation of robots in the military and other uses by foreign countries.
- 10.6** Compares and contrasts robotic labor versus human labor.
- 10.7** Designs, constructs, and programs a robot.

SAMPLE PERFORMANCE TASKS

- Research and illustrate through a presentation a topic in automation.
- Define and explain care-providing robots, nano-robots, reconfigurable robots, and swarm robots in a power point presentation.
- Make observations of the social impact of robots in a written assignment.
- Critique the “Trade Ministry”, ROS, Robotics Developer Window, and “Drones”.
- Define and explain the types of automated guided vehicles (AGV) and it’s purposes.
- Create and compete in the Robotics Competition.

INTEGRATION/LINKAGES

Foundation for Industrial Modernization (FIM). *What Manufacturing Workers Need to Know and Be Able to Do: National Voluntary Skill Standards for Advanced High Performance Manufacturing*. Washington, DC: National Coalition for Advanced Manufacturing, 1995.

International Technology Education Association. Manufacturing Skill Standards Council. *A Blueprint for Workforce Excellence (draft skill standards for manufacturing.)* Manufacturing Skill Standards Council, 2001.

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MANUFACTURING APPLICATIONS

SAMPLING OF AVAILABLE RESOURCES

Principles of Engineering Economy, 8th Edition. John Wiley & Sons. 1990.
Contemporary Engineering Economics. Addison-Wesley Publishing Co., January 1997.
Modern Engineering Economy. John Wiley & Sons, 1993.
Introduction to Business: Our Business and Economic World. Glencoe, 1997.
Introduction to Business, 4th Edition. South-Western Educational Publishing, 2000.
Quick Skills series. South-Western Educational Publishing, 2001.
Succeeding in the World of Work. Glencoe, 1998.
SCANS 2000 Virtual Workplace Simulations. South-Western Educational Publishing /Johns Hopkins University, 2000.

Simulation software resources

(For reference only. Inclusion in this list does not imply endorsement of any product).

ALPHA/Sim®

ALPHATECH, Inc.

www.alphatech.com/alphasim/

AutoMod

by Brooks Automation

www.autosim.com

Deneb/QUEST®

Delmia

www.deneb.com/products/quest.html

Extend+Manufacturing

Imagine That, Inc.

www.imaginethatinc.com/pages/mfg.html

Factory Explorer®

Wright Williams & Kelly

www.wwk.com/fxflier.html

MAST Simulation Environment

CMS Research, Inc.

www.powernetonline.com/~cmsres/mast.htm

Micro Saint

Micro Analysis and Design, Inc.

www.maad.com/MaadWeb/microsaint/msaintma.htm

ProModel®

ProModel Corp.

www.promodel.com/products/promodel/

Rapid Response Manufacturing®

ProfitKey International
www.profitkey.com/rrm.htm

Resource Manager for Excel
User Solutions, Inc.
www.usersolutions.com/products.html

SimCAD Pro
by CreateASoft
www.createasoft.com/

SIMUL8
SIMUL8 Corp.
www.simul8.com/edu4.htm

SyteLine® and SyteCentre®
Frontstep, Inc.
www.frontstep.com/solutions/enterprisemanagement/index.html

Taylor ED
Enterprise Dynamics Corp.
204.250.198.120/software.html

Virtual Factory
EAI
www.eai.com/solutions/VF/overview.html